

A LIST OF THE CURRENTLY PENDING CLAIMS

1. (Currently Amended) An aqueous semiconductor cleaning solution having a pH between about 1.5 and about 6 and comprising:

at least about 75% by weight water;

from about 0.5% to about 10% by weight phosphoric acid;

optionally one or more other acid compounds;

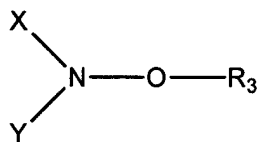
optionally one or more fluoride-containing compounds; and

at least one alkaline compound selected from the group consisting of:

~~a quaternary ammonium hydroxide~~ a trialkylammonium hydroxide and/or

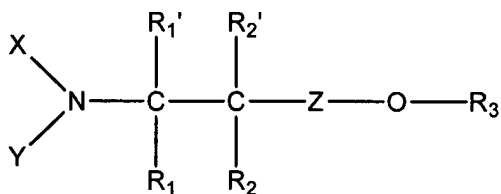
a tetraalkylammonium hydroxide;

a hydroxylamine derivative having the structural formula:



wherein R₃ is hydrogen or a linear, branched, or cyclic hydrocarbon containing from 1 to 7 carbon atoms; and wherein X and Y are, independently, hydrogen or a linear, branched, or cyclic hydrocarbon containing from 1 to 7 carbon atoms, or wherein X and Y are linked together form a nitrogen-containing heterocyclic C₄-C₇ ring; ~~and a mixture thereof; and~~

~~optionally one or more other acid compounds, optionally one or more fluoride-containing compounds, and/or optionally one or more alkanolamines having the structural formula:~~



wherein R₁, R₁', R₂, R₂', and R₃ are, independently in each case, hydrogen or a linear, branched, or cyclic hydrocarbon containing from 1 to 7 carbon atoms; wherein Z

is a group having the formula $-(Q-CR_1R_1'-CR_2R_2')_m-$, such that m is a whole number from 0 to 3 (*i.e.*, when $m=0$, there is no atom between the $-CR_2R_2'$ - group and the $-OR_3$ group in the formula above), R_1 , R_1' , R_2 , and R_2' may be independently defined in each repeat unit, if $m>1$, within the parameters set forth for these moieties above, and Q may be independently defined in each repeat unit, if $m>1$, each Q being independently either -O- or $-NR_3-$; and wherein X and Y are, independently in each case, hydrogen, a C_1-C_7 linear, branched, or cyclic hydrocarbon, or a group having the formula $-CR_1R_1'-CR_2R_2'-Z-F$, with F being either $-OR_3$ or $-NR_3R_4$, where R_4 is defined similarly to R_1 , R_1' , R_2 , R_2' , and R_3 above, and with Z , R_1 , R_1' , R_2 , R_2' , and R_3 defined as above, or wherein X and Y are linked together form a nitrogen-containing heterocyclic C_4-C_7 ring.

2.(Original) The aqueous semiconductor cleaning solution of claim 1, wherein the pH of the solution is between about 2 and about 6.

3. (Original) The aqueous semiconductor cleaning solution of claim 1, wherein the at least one alkaline component comprises a hydroxylamine derivative present in an amount from about 0.3% to about 1% by weight.

4.(Original) The aqueous semiconductor cleaning solution of claim 1, wherein the at least one alkaline component comprises hydroxylamine or N,N-diethylhydroxylamine.

5.(Currently Amended) The aqueous semiconductor cleaning solution of claim 1, wherein the at least one alkaline component comprises a ~~quaternary ammonium compound~~ tri-alkylammonium hydroxide or tetra- alkylammonium hydroxide present in an amount from about 0.5% to about 3% by weight.

6.(Currently Amended) The aqueous semiconductor cleaning solution of claim 1, wherein the at least one alkaline component comprises choline hydroxide.

7.(Original) The aqueous semiconductor cleaning solution of claim 1, which comprises one or more other acid compounds selected from the group consisting of hydrochloric acid, nitric

acid, periodic acid, pyrophosphoric acid, fluorosilicic acid, sulfuric acid, methanesulfonic acid, oxalic acid, lactic acid, citric acid, xylenesulfonic acid, toluenesulfonic acid, formic acid, tartaric acid, propionic acid, benzoic acid, ascorbic acid, gluconic acid, malic acid, malonic acid, succinic acid, gallic acid, butyric acid, trifluoroacetic acid, and mixtures thereof.

8.(Currently Amended) The aqueous semiconductor cleaning solution of claim ~~7~~, 1, wherein the aqueous semiconductor cleaning solution comprises one or more other acid compounds selected from ~~is~~ glycolic acid, methanesulfonic acid, pyrophosphoric acid, oxalic acid, lactic acid, ~~or~~ and citric acid.

9.(Currently Amended) The aqueous semiconductor cleaning solution of claim ~~1~~ 8, wherein the one or more other acids are present in an amount from about 0.2% to about 5% by weight.

10.(Original) The aqueous semiconductor cleaning solution of claim 1, wherein the aqueous semiconductor cleaning solution comprises one or more fluorine-containing compounds ~~are~~ present in an amount from about 0.01% to about 0.1% by weight.

11. (Currently Amended) The aqueous semiconductor cleaning solution of claim 1, wherein the aqueous semiconductor cleaning solution comprises one or more fluorine-containing compounds ~~comprise~~ comprising ammonium bifluoride and/or ammonium fluoride.

12.(Original) The aqueous semiconductor cleaning solution of claim 1, further comprising an organic solvent in an amount from about 5% to about 15% by weight.

13.(Currently Amended) The aqueous semiconductor cleaning solution of claim ~~1~~ 12, wherein the organic solvent comprises an organic acid ester.

14.(Original) The aqueous semiconductor cleaning solution of claim 1, further comprising a surfactant.

15.(Currently Amended) The aqueous semiconductor cleaning solution of claim 1, ~~further comprising~~ wherein the at least one alkaline compound includes one or more alkanolamines selected from the group consisting of monoethanolamine, 2-(2-hydroxyethylamino)ethanol, 2-(2-aminoethoxy)ethanol, N,N,N-tris(2-hydroxyethyl)-ammonia, isopropanolamine, 3-amino-1-propanol, 2-amino-1-propanol, 2-(N-methylamino)ethanol, 2-(2-aminoethylamino)ethanol, and mixtures thereof.

16.(Currently Amended) The aqueous semiconductor cleaning solution of claim 1, wherein the at least one alkaline compound includes one or more alkanolamines is present in an amount from about 0.5% to about 5% by weight.

17. (Original) The aqueous semiconductor cleaning solution of claim 1, wherein the solution is substantially free from other acid compounds.

18. (Original) The aqueous semiconductor cleaning solution of claim 1, wherein the solution is substantially free from fluoride-containing compounds.

19. (Original) The aqueous semiconductor cleaning solution of claim 1, wherein the solution is substantially free from alkanolamines.

20. (Original) The aqueous semiconductor cleaning solution of claim 1, wherein the solution contains substantially no additional components.

21. (Original) The aqueous semiconductor cleaning solution of claim 1, wherein the solution is substantially free from hydroxylamine derivatives.

22. (Original) The aqueous semiconductor cleaning solution of claim 1, wherein the solution is substantially free from organic solvents.

23. (Original) The aqueous semiconductor cleaning solution of claim 1, wherein the concentration of water is at least about 85% by weight.

24.(Currently Amended) A dilute aqueous semiconductor cleaner and residue remover having a pH between about 1.5 and about 6 and comprising:

a polar solvent selected from water, optionally in a mixture with or a mixture of water and one or more polar organic solvents, wherein the water is present in an amount of at least about 75% by weight;

phosphoric acid or salt thereof, present in an amount from about 0.1% to about 6% by weight of 85% phosphoric acid;

~~optionally, a quaternary ammonium compound, present in the solution in an amount from about 0.2% to about 5% by weight;~~

hydroxylamine or a hydroxylamine derivative, present in the solution in an amount from about 0.1% to about 5% by weight not including the counterion of the hydroxylamine derivative salt, if present;

optionally, a tri-alkylammonium hydroxide and/or tetra-alkylammonium hydroxide, present in the solution in an amount from about 0.2% to about 5% by weight;

optionally, an alkanolamine, present in the solution in an amount from about 0.2% to about 5% by weight;

optionally, a fluoride-containing compound, present in the solution in an amount from about 0.001% to about 0.5% by weight;

optionally, an other acid compound, present in the solution in an amount from about 0.05% to about 6% by weight;

optionally, a chelating agent, present in the solution in an amount from about 0.1% to about 8% by weight; and

optionally, a surfactant, present in the solution in an amount from about 0.01% to about 3% by weight.

25.(Currently Amended) A The dilute aqueous cleaner and residue remover of claim 24, wherein the cleaner and residue remover consists consisting essentially of: water; about 1.5% to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a hydroxylamine or hydroxylamine derivative; and about 0.005% to about 0.04% by weight of a fluoride-

containing compound, and wherein the cleaner and residue remover is substantially free from surfactants.

26.(Original) A The dilute aqueous cleaner and residue remover of claim 24, wherein the cleaner and residue remover consists ~~consisting~~ essentially of: about 1.5% to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a hydroxylamine derivative; about 0.005% to about 0.04% by weight of a fluoride-containing compound; and about 0.05% to about 0.2% by weight of a surfactant.

27. (Previously Presented) A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5% to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a hydroxylamine or hydroxylamine derivative; and about 0.005% to about 0.1% by weight of a fluoride-containing compound.

28.(Original) A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5% to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a hydroxylamine derivative; about 0.005% to about 0.1% by weight of a fluoride-containing compound; and about 5% to about 15% by weight of a polar organic solvent.

29.(Currently Amended) A dilute aqueous semiconductor cleaner and residue remover consisting essentially of: ~~about~~ 1.5% to about 2.5% by weight of phosphoric acid; and ~~about~~ 0.5% to about 1.5% by weight of a ~~quaternary ammonium~~ tri- alkylammonium salt and/or tetra-alkylammonium salt.

30.(Previously Presented) A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5% to about 4% by weight of 85% phosphoric acid; about 0.3% to about 4% by weight of oxalic acid dihydrate; about 0.3% to about 4% by weight of a monofunctional organic acid; about 90% to about 99% by weight of water; and optionally between about 0.1% and about 1% of a chelator, wherein the formulation contains substantially no organic solvents and no compounds listed as SARA 3 hazardous compounds on the filing date of this application.

31.(Currently Amended) A dilute aqueous cleaner and residue remover consisting essentially of: about 0.5% to about 6% by weight of 85% phosphoric acid; about 2% to about 12% by weight of oxalic acid dihydrate; optionally about 0.2% to about 15% by weight of a monofunctional organic acid; optionally between about 0.05% and 1.5% by weight of: ammonium hydroxide, an alkyl ammonium hydroxide substituted with 2 or 3 alkyl moieties independently selected from methyl and ethyl moieties, or a mixture thereof; optionally between about 0.1% and about 1% of a chelator; and water, wherein the pH of the cleaner and residue remover is between 1.5 and 9, and the cleaner and residue remove ~~the formulation~~ contains substantially no organic solvents and no compounds listed as SARA 3 hazardous compounds on the filing date of this application.

32. (New) A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5% to about 4% by weight of 85% phosphoric acid; about 1% to about 4% by weight of glycolic acid; and about 92% to about 97.5% by weight of water.

33. (New) The semiconductor cleaning solution of claim 32, wherein the solution is substantially free from: alkanolamines, quaternary ammonium compounds, hydroxylamine and hydroxylamine derivatives, other acid compounds, fluoride-containing compounds, organic solvents, non-hydroxyl-containing amines, chelating agents, and surfactants.

34. (New) A dilute aqueous cleaner and residue remover consisting essentially of: about 3% to about 6% by weight of 85% phosphoric acid; about 1% to about 2% by weight of glycolic acid; and about 92% to about 96% by weight of water.

35. (New) The semiconductor cleaning solution of claim 34, wherein the solution is substantially free from: alkanolamines, quaternary ammonium compounds, hydroxylamine and hydroxylamine derivatives, other acid compounds, fluoride-containing compounds, organic solvents, non-hydroxyl-containing amines, chelating agents, and surfactants.